

REMARKS

Applicant has carefully reviewed and considered the Office Action mailed on November 7, 2001, and the references cited therewith.

Claims 16, 17, and 19-22 are amended; as a result, claims 1-28 and 39-47 are now pending in this application. No new matter was added to the written description. The amendment of the claims was within the scope of the claims as originally presented and examined. Therefore no further search or consideration is required.

Rejections Under 35 U.S.C. § 112

Claims 19-21 and 26-28 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The Office Action reasons, “[i]t is claimed that an etch results in an SOI structure, which is not clear how this is accomplished either in the claims or the specification. The Applicant respectfully traverses this rejection and requests the Office to consider the following.

The specification need not disclose what is well-known to those skilled in the art and preferably omits that which is well-known to those skilled and already available to the public. (M.P.E.P. § 2164.05(a)). Silicon-on-insulator structures are well-known to those skilled in the art and are regularly purchased by the public from vendors for further processing. The Office Action mischaracterizes what is claimed. Where the Office Action asserts “an etch results in an SOI structure”, claim 19 states “an etch . . . that forms a silicon-on-insulator topology of a plurality of semiconductor channels” The claimed process is an etch that results in an SOI topology and does not disclose what is well-known; how to make an SOI structure.

Typically, an SOI structure is a monolithic piece of monocrystalline silicon that has had an oxide layer implanted deep below one surface. Consequently, one obtains an SOI structure. The SOI structure includes a bulk body of silicon (such as Item 52 in Figure 6), the oxide layer insulator substrate (such as Item 50 in Figure 6), and the silicon-on-the insulator (indicated by

item 720, as a residual of the silicon-on-insulator layer as it existed before processing).

Figure 7 relies upon repeating process embodiment themes in the written description. Additionally, Figure 7 teaches that a well-known SOI structure has been processed according to an embodiment of the present invention to achieve remaining portions of an SOI substrate (Items 720, 50, and 52 in Figure 7). The process embodiment themes in the written description, call out the remaining portions of the SOI structure (Items 52, 50, and 720) that are evidence of processing similar to the remaining portions of the substrate 12 (Items 12 and 20 in Figures 1 and 2, Items 12 and 320 in Figures 3, Items 12 and 420 in Figure 4, Items 12 and 520 in Figure 5, and Items 12 and 620 in Figure 6). The presence of the second nitride spacer mask 28, for example in both Figure 2i and Figure 7 indicates, consistent with the processing themes in the written description, that a similar process path has been undertaken in each embodiment to achieve the respective topologies that include the respective etched quantum wires 20 and 720. Because the Applicant has presented a disclosure that enables one of ordinary skill in the art to achieve the topologies depicted in the written description, withdrawal of this rejection is respectfully requested.

Claims 16-21 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The Office Action reasons that "Claim 16 states on lines 6 and 10 that the width of the spacer is equal to the thickness of the layer of spacer material deposited." (Office Action at page 2). Claim 16 has been amended to further define what the Applicant regards as his invention which obviates the grounds for this rejection. Regarding claim 16, line 6, support for the amendment (*i.e.*, rephrasing the language to "about equal") is found in the specification at page 9, lines 12-14. Regarding claim 16, line 10, support for the amendment (*i.e.*, rephrasing the language to "about equal") is found in the specification at page 9, lines 17-19. Withdrawal of the rejection is respectfully requested.

Claims 16-21 and 26-28 recite the limitations of "X" in each claim. The Office Action reasons, "[t]here is insufficient antecedent basis for this limitation in the claim." Regarding

claims 26-28, the Applicant respectfully asserts that the Office Action is mistaken. The Applicant directs the Office's attention to independent claim 22 (from which claims 26-28 depend). Regarding the rejection directed to claims 26-28, withdrawal of the rejection is respectfully requested.

Regarding the rejection of claims 16-21, although the Applicant respectfully disagrees with the Office Action (the antecedent basis of "X" in claims 19-21 is implied, as it restates in quantitative terms the "first width" language of claim 16, at line 2), the Applicant has amended claims 17 and 19-21 to more particularly point out what the Applicant regards as his invention. Although no similar rejection was asserted against claim 17 the Applicant notes that claim 17 also the "X" terminology therein. For example, claim 17 now states that the mean free electron path in each of the plurality of channels is larger than about one-tenth the first width. Withdrawal of this rejection is respectfully requested.

Rejections Under 35 U.S.C. § 103

Claims 1-6, 9-16, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chapple-Sokol et al. (U.S. Patent No. 5,612,255). The Applicant respectfully traverses this rejection and requests the Office to consider the following.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaack, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (M.P.E.P. § 2143 7th Ed).

First, the Office action admits that "Chapple-Sokol does not teach the practice of forming spacers on spacers to further reduce the size of the quantum wire even further." (Office Action at page 4). The Office Action then concludes that "[i]t would be obvious to one skilled in the art to

merely duplicate the Chapple-Sokol process twice to further reduce the width of the wire. It has been held that mere duplication of part or processes involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8, 10.” (Ibid.). The Applicant respectfully asserts that the Office Action has significantly mischaracterized the ruling in *St. Regis*. The ruling in *St. Regis* requires the invention to “rearrange old elements in new combinations”. The limitations of the instant claims have a new element; forming a second nitride spacer mask on the first oxide spacer mask (Claim 1).

Regarding the first criterion to establish a *prima facie* case of obviousness, Chapple-Sokol does not teach or suggest motivation to modify his process to teach what is claimed. The suggestion to modify his process is not found in his disclosure. Rather it is found in the Applicant’s disclosure. Further, the bag-making technology of *St. Regis* cannot be construed to cover the technical field of the instant invention, neither can it be construed to cover the scope of what is claimed, as *St. Regis* relates to a combination of old elements. Because there is no suggestion in Chapple-Sokol to modify his process in a manner that is similar to what is claimed, withdrawal of the rejection is respectfully requested.

Regarding the second criterion that there must be reasonable expectation of success (with regard to Chapple-Sokol achieving what is claimed), the Applicant notes that Chapple-Sokol fails to suggest further size reduction, and also refers to a “final structure” (Chapple-Sokol at column 3, line 46-47) that is directed to processing unrelated to further processing of the wire size. The “final structure” language indicates that Chapple-Sokol has completed his thought process. The only reasonable expectation of success that can be found in the record is in the Applicant’s disclosure. Because Chapple-Sokol discloses no reasonable expectation of success to achieve what is claimed, withdrawal of the rejection is respectfully requested.

Regarding the third criterion that prior art reference must teach or suggest all the claim limitations, it has already been demonstrated that Chapple-Sokol is devoid in teaching or suggesting what is claimed. Withdrawal of the rejection respectfully requested.

At page 4, the Office Action admits that Chapple-Sokol does “not . . . specifically state the use of a nitride spacer mask instead of a poly spacer mask.” Next, the Office Action reasons

that “[i]n terms of spacer masks, nitride and poly are well known to be equivalent materials and it would have been obvious to one skilled in the art to substitute one for the other and provide for greater process latitude.” (Ibid.) The Applicant respectfully traverses this rejection and requests the Office to consider the following.

The Applicant disagrees with the Office Action’s assertion that “nitride and poly are well known to be equivalent materials.” Etch processing has profoundly disparate results between nitride materials and polysilicon materials. The variables include, but are not limited to the chemical composition of the materials, and the etch recipe. Regarding the chemical composition of the materials, even two unlike nitride materials or two unlike polysilicon materials will be non-equivalent etch compositions. Regarding the etch recipe, it includes such variables as the chemical composition of the etch medium, convective forces, vapor or liquid state, time, temperature, and pressure conditions. Because nitride and poly spacers are not equivalent materials as related to what is claimed, withdrawal of the rejection is respectfully requested.

The Office Action gives official notice, at page 4, that “triple-gate FETs are well known in the art.” The Office Action next reasons that “it would be obvious to employ multiple gate FET technology to Chapple-Sokol’s quantum wire FET to provide for multiple inputs into the switching device and therefore enhance the capabilities of the device.” (Ibid.). The Applicant respectfully traverses this official notice and requests the Office to consider the following.

The deficiencies of Chapple-Sokol as set forth herein are incorporated by reference. Beside the deficiencies of Chapple-Sokol and assertions of the Office Action failing to establish a *prima facie* case of obviousness for independent claims 1 and 16, obviousness requires that “the subject matter sought to be patented . . . as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains.” 35 U.S.C. § 103(a). While it may be true that “triple-gate FETs are well known in the art” (Office Action at page 4), the claimed method as a whole is neither taught nor suggested by the prior art. Chapple-Sokol does not teach or suggest the claimed process path that results in a triple-gate FET, neither does Chapple-Sokol with any combination of teachings from what may be well known as asserted in the Office Action. Any teaching or suggestion to make the claimed

combination or modify teachings in Chapple-Sokol is found, not in Chapple-Sokol, but only from the Applicant's disclosure. Withdrawal of the rejection is respectfully requested.

Claims 7-8, 17, 19-28, and 39-47 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Chapple-Sokol et al. (U.S. Patent No. 5,612,255) as applied to claims 1-6, 9-16, and 18 above, and further in view of Kendall (Kreidl Memorial Lecture, Oct. 30, 1995). The Office Action states that "Kendall teaches the art of quantum wire arrays and related geometries [and that] Chapple-Sokol also teaches various geometries" (Office Action at page 4). The Office Action next reasons that "[i]t would have been obvious to one of ordinary skill in the art to employ the claimed geometries in the teachings of Chapple-Sokol and Kendall. (Ibid.). The

Applicant respectfully traverses this rejection and requests the Office to consider the following.

Kendall does nothing to rectify the deficiencies in Chapple-Sokol. Because the Applicant is claiming a process, it is significant that Kendall offers a process that is radically different from Chapple-Sokol. These radically different processes indicate no suggestion or motivation to combine the teachings of Chapple-Sokol and Kendall. Further, Kendall is a speculative paper as indicated by the subtitle, "(Top ten speculations from bulk micromachining)". Kendall's geometries are disparately different from those taught and claimed. A review of Kendall indicates that his process, by whatever means, achieves a structure "several micrometers high", which is a vague, speculative, and non-enabling disclosure. Kendall's disclosure therefore fails to quantify the height of Kendall's structures, such that the assertion in the Office Action of "mere" changes in dimensions is unverifiable since one cannot ascertain from Kendall what would be a "mere" change, let alone a quantifiable "mere" change. Thus the teaching or suggestion to combine Chapple-Sokol with Kendall to achieve what is claimed, comes from the Applicant's disclosure. Withdrawal of this rejection is respectfully requested.

Kendall further teaches his "several micrometers high" structure is, "as small as 50 Angstroms width separated by 10,000 or less." (Kendall, first page). This patterning translates to a ratio of 1:200. By contrast for example, Claim 7 includes a ratio of 1:3, claim 8 includes a ratio of 1:3.2, and claim 39 includes a ratio of 1:5. It cannot be asserted what is claimed by the Applicant is "mere change in dimensions" from what is taught by Kendall, (Office Action, page

5), both due to Kendall's speculative disclosure, his vague, speculative, and non-enabling "several micrometers high", and because Kendall's ratio dwarfs any ratio claimed by the Applicant. Even where Kendall possibly teaches another ratio that is smaller (50 Angstrom wide and 0.34 micron pitch; a ratio of about 68), it remains several orders of magnitude larger than what is claimed by the Applicant. Because scaling requires preservation of dimensional ratios, a cursory view of Kendall's structures indicate a significant aspect ratio (Figure 1b and supporting text at first page) that weakens any assertion that Kendall can be scaled to achieve what is claimed by the Applicant.

An appeal to Chapple-Sokol does nothing to assist the deficiencies in the disclosure of Kendall to suggest what is claimed by the Applicant. Chapple-Sokol begins by teaching "500 Å oxide pads 102" (Chapple-Sokol at column 2, line 52) that are vague as to which dimension this measurement should apply; height or width. Even where it may be arbitrarily applied to a width (or both for that matter), Chapple-Sokol offers nothing more to suggest a pitch between two quantum wires. This omission by Chapple-Sokol indicates that he neither appreciated nor was concerned with the pitch. Accordingly, nothing in Chapple-Sokol can be construed to be a "mere" change in dimension, let alone a quantifiable "mere" change in dimension, since Chapple-Sokol offers none with which to compare. Withdrawal of the rejection is respectfully requested.

The Office Action lastly asserts that "applicant has failed to disclose the critical nature or unexpected results arising therefrom." (Office Action at page 5). The Office Action then reasons "[o]ne would be motivated to combine the teachings of Kendall with Chapple-Sokol in order to reduce the geometries of the QWFET to increase both performance and density of devices." (Ibid.). The Applicant respectfully traverses this rejection and requests the Office to consider the following.

The assertion by the Office Action that "[o]ne would be motivated to combine the teachings of Kendall with Chapple-Sokol in order to reduce the geometries of the QWFET to increase both performance and density of devices" cannot be supported by a review of Chapple-Sokol and Kendall, either separately or together. Chapple-Sokol is entirely silent on "reducing

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geometries of the QWFET to increase both performance and density of devices." The only section where Chapple-Sokol discusses performance (Chapple-Sokol at column 3, line 52 to column 4, line 31) concerns a single QWFET. This fails to suggest how Chapple-Sokol could teach density of devices. Kendall, similarly, is entirely silent on reducing geometries. A careful review of the references and the Applicant's disclosure reveals that such a motivation is only to be found in the Applicant's disclosure. Accordingly, such reasoning can also come only from the Applicant's disclosure. Withdrawal of the rejection is respectfully requested.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 7 day of February, 2002.

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